

AUTONOMOUS VEHICLES AND EV



The Global Landscape

The volatility in global fuel prices and intensity of climate change has led to the rise in demand for electric vehicles (EV). In 2021, the number of EV sales hit 6.75 million, 108% more than in 2020. These sales not only included passenger vehicles but light trucks and light commercial vehicles too.

Though the growth rate looks impressive, seen relative to 2020 when regulations and the pandemic caused sales to dip, 2021 was a year for recovery. For 2022, EV sales are expected to return to normal growth to reach around 9.5 million and higher depending on if supply and logistics issues are resolved.¹

Q1 of 2022 alone saw the registration of over 2 million new passenger plug-in cars. Compare that to the 1.1 million registered in Q1 of 2021 and one knows that this year's numbers are going to be much higher than 2021.²

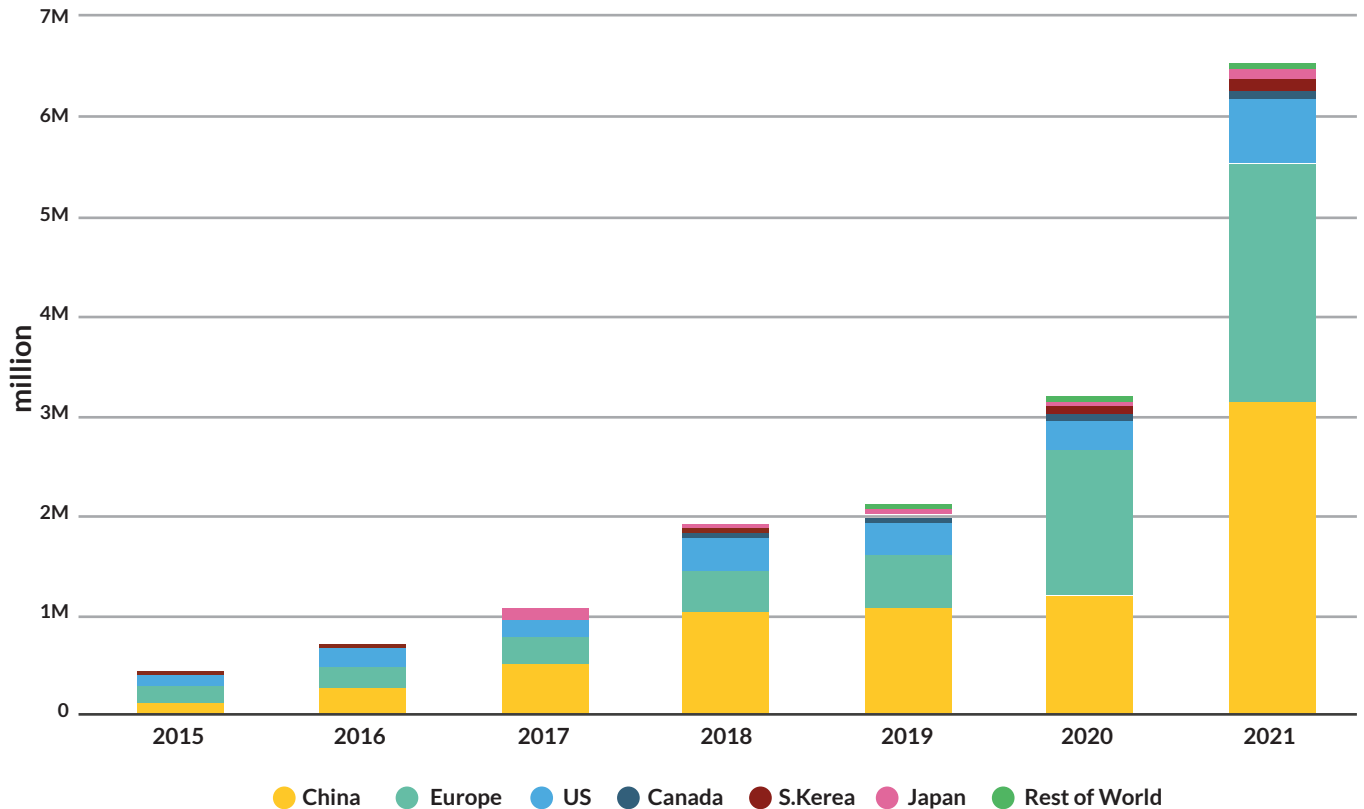
Projection rates are especially high for the Asia-Pacific market as the rise in fuel costs is pushing for more demand for low-emission, cost-efficient vehicles. Meanwhile, growth in the North American and European markets may be attributed to green initiatives put forth by their respective governments. However, there are certain challenges that need to be overcome before



¹<https://insideevs.com/news/583538/world-top-oem-ev-sales-2022q1/>

²<https://insideevs.com/news/583538/world-top-oem-ev-sales-2022q1/>

Global passenger EV sales by market³



the market can fully ripen on a global scale. EV charging stations are not present in enough places and the initial investment associated with this segment is too high.

While demand for petrol has been rising and supply dwindling with the non-renewable product expected to run out within a few decades, the future of the automobile industry lies in electric vehicles.

Rising rates of global warming have also led to countries around the world pledging to reduce vehicle emissions by 2050. This has resulted in an uptake in the development of EVs. Governments all over the world are

now providing numerous kinds of incentives such as zero or low registration fees and exemptions from taxes for such ventures.

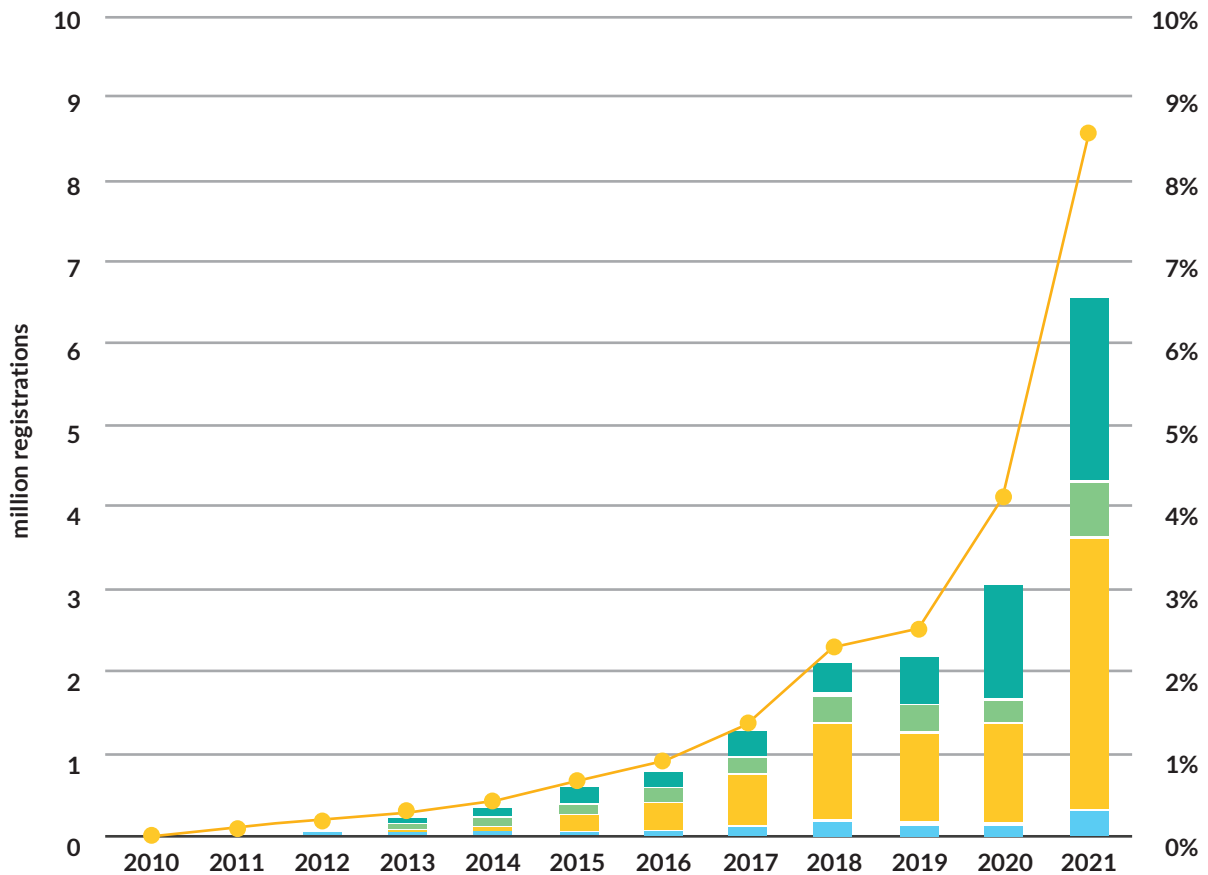
Globally, there are 1.2 to 1.3 billion cars on the road with 60 million of them being EVs. While the share of EVs in this is low, environmentalists and EV manufacturers are both pushing for this number to increase in the coming years.

Tesla, which currently reigns in the EV market, sold its first EV called the Roadster in 2008 and sold over 936,000 units in 2021. With a 14% market share, Tesla was followed closely by the VW group which captured 11% of the market.⁴

³<https://about.bnef.com/electric-vehicle-outlook/>

⁴<https://www.forbes.com/sites/mikepatton/2022/03/30/competition-heats-up-for-tesla-in-ev-market/?sh=3dac27c23423>

Global Sales and Sales Market Share of Electric Cars, 2010-2021⁵



China has been leading global growth in the EV market with 3.4 million cars sold in 2021 while in Europe, sales increased by nearly 70% to 2.3 million. China, Europe and the United States account for roughly two-thirds of the overall car market, but around 90% of electric car sales.⁶

Funding for EV startups hit a 10-year high in 2021, reaching more than \$20 billion. The funding amount was more than double of the \$10 billion raised by the EV sector in 2020.

The growth in the EV space has been picking up over the past years with giants like Ford Motors and General Motors pledging billions to EVs in the next few years.

Ford also announced that it would reorganize the company to split its EV and combustion engine units into separate businesses while Sony and Honda announced a partnership to form a new company that develops electric vehicles.⁷ The EV industry is currently home to 17 unicorns.⁸

⁵<https://www.iea.org/data-and-statistics/charts/global-sales-and-sales-market-share-of-electric-cars-2010-2021>

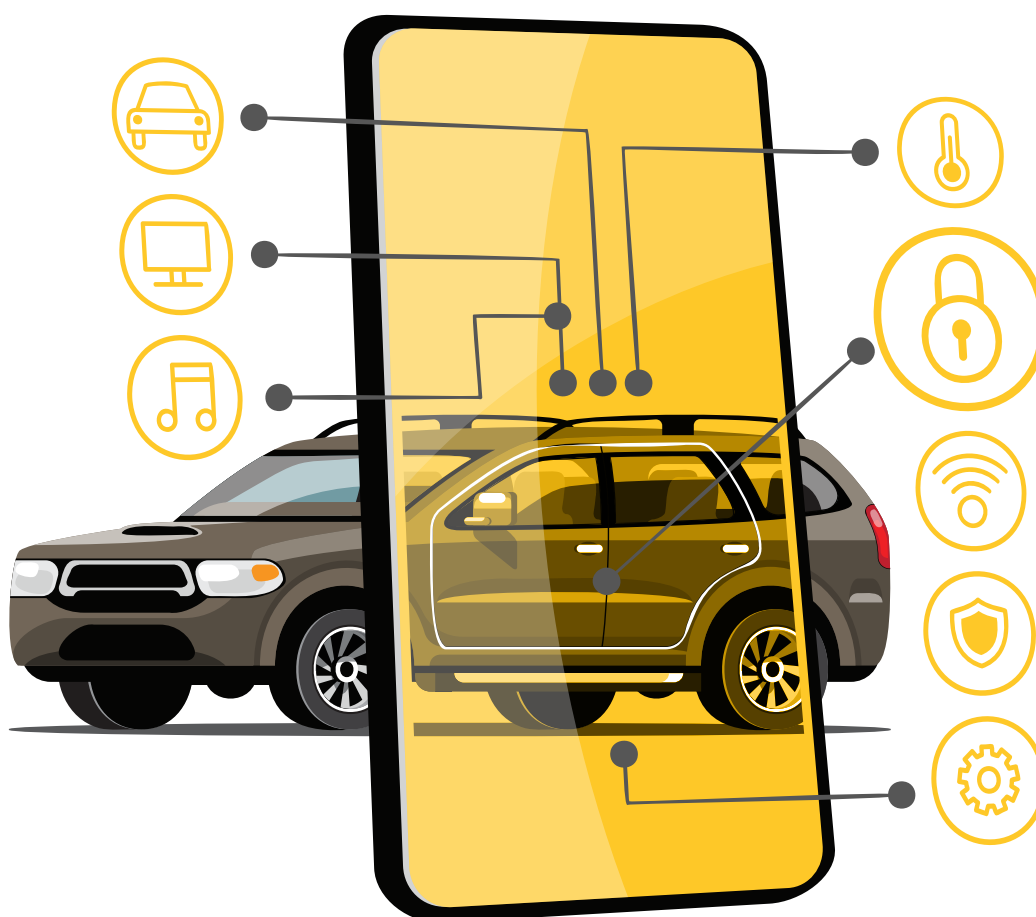
⁶<https://www.iea.org/commentaries/electric-cars-fend-off-supply-challenges-to-more-than-double-global-sales>

⁷<https://news.crunchbase.com/transportation/ev-investment-tesla-ford-sony-honda/>

⁸<https://www.failory.com/startups/electric-vehicle-unicorns>

Most Valuable Healthcare Startups

Company	Value	Country
Bolt	\$11 billion	United States
Ola Electric Mobility	\$5 billion	India
WM Motor	\$5 billion	China
Redwood Materials	\$3.8 billion	United States
Youxia Motors	\$3.6 billion	China



On-Board Charge Motor	Power Conditioner
Reducer	Air Compressor
Fuel Stack	Humidifier
Power Control Unit	Battery Cells & P
Fuel Processor	Battery Management System

EV Market, Based on Vehicle Type
 → Passenger Cars
 → Commercial Vehicles

EV Market, Based on Vehicle Class
 → Mid-priced
 → Luxury

EV Landscape in Pakistan

Policy Regulations in Pakistan

Since Pakistan is a signatory to the Paris Climate Agreement, which has pledged to reduce greenhouse gas emissions by 20% by 2030, the country is committed to adopting a greener approach to vehicles. The world is currently undergoing a climate change emergency. According to a UNDP report, climate change losses to Pakistan's economy are going to exceed \$3.8 billion. Therefore, the country has started to take a greener

approach to its businesses. While climate change is a major driver for the adoption of green policies, the country is also on a mission to decrease reliance on imported petroleum products. With both environmental and economic factors pushing for electric mobility, Pakistan started pushing for greener transportation options through policy changes in 2019.

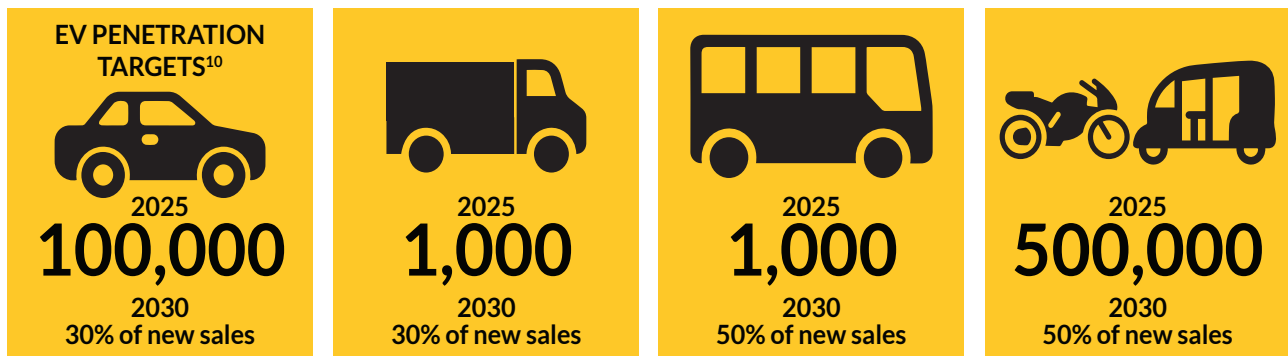


Pakistan's Green Policy

The first green policy was launched in 2019. The policy envisioned that 30% of the vehicles in the country would be electric cars by 2030 with the number increasing to 90% by 2040. The agreement also specified the development of infrastructure needed for the promotion of EVs including the installation of charging infrastructure in every major city. Lahore was chosen for the rolling out of this feature due to the smog

conditions in the city and the fact that switching to EVs would lower emissions from vehicles. Other incentives included all locally manufactured EVs to be sold at less than 1% GST for the next seven years as well as exemption from annual token tax and registration fees.⁹

⁹https://rise.esmap.org/data/files/library/pakistan/Energy%20Efficiency/Pakistan_Draft%20EV%20Policy%20Pakistan_2019.pdf



The next amendment to these policies came in 2020 in the form of the Electric Vehicle and New Technology Policy 2020-2025 with additional incentives for both local manufacturing and import of EVs.¹¹ This policy was followed by another amendment in the form of a New Auto Industry Development and Export Policy in 2021.

The policy dictated a slashed sales tax on EVs from 17% to 1%. Moreover, customs

duty on the import of EVs completely built-up (CBU) was slashed to 10% from 25%; while customs duty on specific parts of electric vehicle motorcycles, three-wheelers, and heavy commercial vehicles was set at 1%.¹²

The Senate Standing Committee on Climate Change also recommended using EVs for school transport in 2021.¹³

TYPES	INCENTIVES FOR PASSENGER CARS
CBUs	<ul style="list-style-type: none"> → Import allowed at 25% Custom Duty (CD), 0% Additional Custom Duty (ACD), 0% Regulatory Duty (RD), 0% Value Added Tax (VAT) and 0% Federal Excise Duty (FED) → Import of 100 CBUs per company @ 50% of the prevailing CD rate
CKDs	<ul style="list-style-type: none"> → Import of EV specific parts including batteries, motors, motor control units and peripheral electronics allowed at 1% CD, 0% ACD, 0% RD, 0% VAT and 0% FED. → Import of CKD kits for small cars/SUVs with 50kWh battery or below and LCVs with 150kWh → Battery; <ul style="list-style-type: none"> ● Exemption on sales tax and VAT on import and 1% sales tax on sales ● 1% Withholding Tax (WTH) ● Exemption on GST and VAT at import stage

¹⁰https://pdf.usaid.gov/pdf_docs/PA00XXDK.pdf

¹¹<http://www.engineeringpakistan.com/wp-content/uploads/2020/08/EV-New-Tech-Policy-060420.pdf>

¹²<https://www.thenews.com.pk/latest/919171-pakistan-auto-policy-2021-26-sales-tax-slashed-on-local-electric-vehicles>

¹³<https://www.dawn.com/news/1662928>

TYPES	INCENTIVES FOR PASSENGER CARS
Manufacturing Plant and Machinery	→ Duty free import allowed at 0% CD, 0% ACD and 0% RD
EV Chargers	→ Import allowed at 1% CD, 0% ACD and 0% RD
Registration and Annual Renewal Fee	→ Reduced rate based on provincial policies
Financing	→ Financing allowed at 1+5% (State Bank of Pakistan) ¹⁴

TYPES	INCENTIVES FOR TWO & THREE-WHEELERS	INCENTIVES FOR HTVS
CBUs	Import of 200 units allowed at a concessionary duty rate (50% of prevailing rate of CD) with the condition of establishing local manufacturing facilities.	Import allowed at 1% CD
CKDs / EV Specific Parts	EV specific parts import allowed at 1% CD for five years	CKD imports allowed at 1% CD for local assembling/ manufacturing
Sales Tax	Waived at import stage	Waived at import stage
Registration and Annual Renewal fee	<ul style="list-style-type: none"> → Reduced registration rate based on provincial policies → Toll tax reduced to 50% 	<ul style="list-style-type: none"> → Reduced registration rate based on provincial policies → Complete waiver for annual token tax and permits

¹⁴https://pdf.usaid.gov/pdf_docs/PA00XXDK.pdf

Zooming in on the Market in Pakistan

As of 2021, there were over 24 million two and three wheelers, 4 million passenger cars and 0.5 million buses and trucks in Pakistan, while the number of electric vehicles was barely 2000. Two wheelers have the largest share among all vehicle segments due to their lower purchase price as compared to four wheelers. Three-wheelers come in at second due to the lack of public transport infrastructure that makes families reliant on rickshaws for all their mobility needs.

Cars are mainly owned by those with higher-incomes. However current economic conditions which include the devaluation of the dollar, sky-high increase in petrol prices and increasing inflation, car ownership is becoming more expensive by the day, opening up a new market for electric mobility solutions.

Total Registered Vehicles in Pakistan (In millions)



Number of registered vehicles in the country during 2020¹⁶

When it comes to assembly and manufacturing, Pakistan has a well developed industry. Almost all two and three wheelers are manufactured in Pakistan except for hybrid vehicles, plugin hybrid electric vehicles and high-end luxury cars. Trucks are also locally manufactured while buses are imported.

Seeing the potential in the EV market in Pakistan, the country has seen a lot of interest from international players who

want to develop the EV ecosystem in the country. In 2021, automobile giant Toyota announced an investment of \$100 million in Pakistan to develop hybrid electric vehicles.

Indus Motor Company was chosen as a beneficiary to produce the first hybrid electric vehicle in the country.¹⁷ Before that, there was Topsun Motors, a collaboration between Pakistan and China that introduced EVs in Pakistan in

¹⁶https://pdf.usaid.gov/pdf_docs/PA00XXDK.pdf

¹⁷<https://www.toyota-indus.com/toyota-usd-100-million-investment-in-pakistan/>

2020. Besides Toyota, players like BYD have also shown interest by partnering up with local players like Rahman Group to produce electric buses and cars.¹⁸

Other similar partnerships include Chongqing Changan Automobile Limited with Master Motors, Jinbei with Zenith Automotive, Proton with Al Haj Automotive Private Limited. Though many would like to switch to EVs given the money they save in the long run, the steepness of the initial investment is often found to be off putting. A solution for that was introduced by Nayyar Motors in April 2022 by importing Rinco Aria, a car assembled in China which is touted as the cheapest EV in Pakistan at a

price of PKR 2.4 million.¹⁹ Chinese auto group Gauss Auto also entered the Pakistani EV market by announcing plans to establish an EV manufacturing plant in Pakistan's Special Economic Zone. The agreement to establish this plant near Port Qasim was signed with AKD Holdings in May 2022.²⁰

While there are many options for private EVs, the first electric commercial vehicle was introduced in the country in January 2022 after a collaboration between Sitara Engineers and Tesla Industries. An 11-seater minibus and a cargo van with one-ton load capacity that uses a solar charging station was a part of the



¹⁸<https://propakistani.pk/2018/06/11/rahmat-group-is-launching-electric-cars-in-pakistan-this-year/amp/>

¹⁹<https://www.globalvillagespace.com/rinco-aria-pakistans-cheapest-ev/>

²⁰<https://tribune.com.pk/story/2357399/chinese-group-to-set-up-ev-plant>

exhibition. Initially, these ECMs are being imported from China, but their assembly is slated to start in Pakistan in a year or two.²¹

It was also announced in 2021 by Changan Motors that they would be the first ones to introduce an autonomous vehicle in Pakistan called the Uni T.²² With initial testing conducted on Pakistan's busy roads, the car is set to launch in the country in the next few months.

On the bike front, Pakistan's first locally produced electric bike company, Jolta, saw a sale of 100,000 units in 2021 with many other local players gearing up to launch their own spins. A solution was also found for another major emissions contributor rickshaws, in the form of an electric rickshaw introduced by Sazgar Engineering Works. Currently manufacturers are providing a slow home-based charger with the vehicles which can take up to 8 hours to completely charge the battery due to non-availability of commercial scale charging facilities.

While the advantages of adopting a greener automotive policy by switching to EVs are many, the load shedding issues in Pakistan may provide a cause for concern. Many believe that charging stations would not receive an uninterrupted power supply, thus making it hard for people to use their EVs for long ranges. However, the government has made concessions in order to address this problem. The country is diversifying its



energy sources in order to increase power generation and thus ensure that charging stations are always up for usage. In this regard, Shell signed an MOU with K-Electric in 2021 to establish EV charging stations in Karachi over the next 3-5 years.²³

A similar MOU was also signed between Dewan Motors and Frontier Works Organization to install EV charging stations on the motorway between Lahore and Islamabad.²⁴ Since the initial set up costs as well as operating costs for developing fast chargers are quite high, there are not many market players who are ready to offer this solution. The cost of each fast charger runs more than \$20,000 and the development of local cheaper options demands lots of money being poured into R&D.

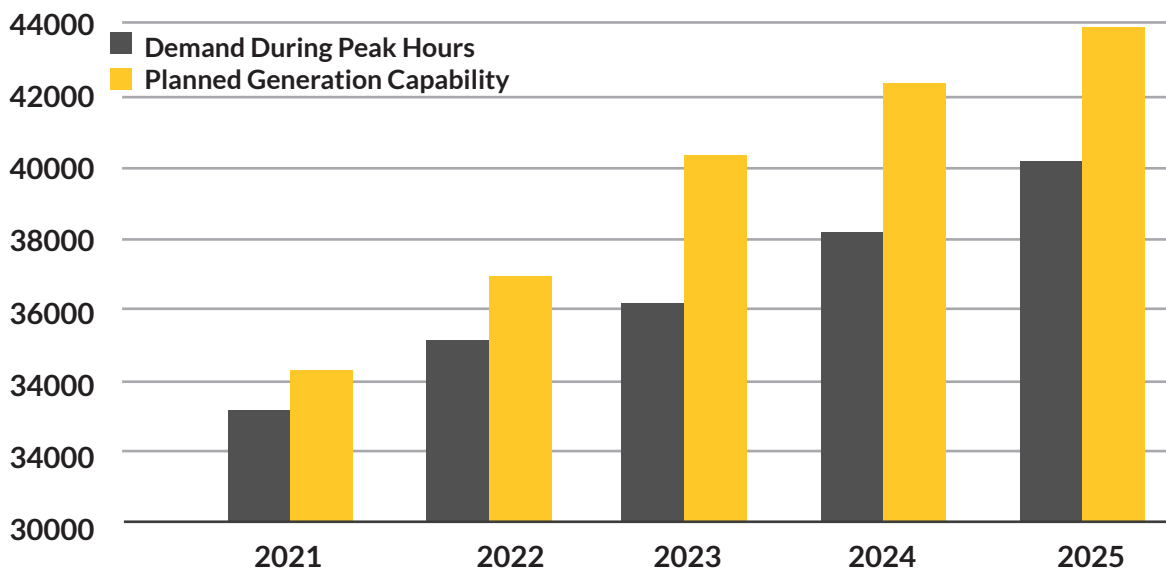
²¹<https://www.thenews.com.pk/print/926385-two-pakistani-companies-showcase-first-electric-vehicle>

²²<https://timesofislamabad.com/25-May-2021/self-driving-cars-to-enter-pakistani-market>

²³<https://www.shell.com.pk/motorists/shell-recharge.html>

²⁴ <https://profit.pakistantoday.com.pk/2022/07/01/fwo-pso-to-establish-petrol-stations-in-northern-areas>

Current and Forecasted Power Demand and Supply (In MW)²⁵



Alongside the growth of the electric vehicle market, there also needs to be substantial growth in the battery market because if Pakistan aims to reach its targetted share of 30-50% of electric vehicles by 2030, this requires 60-80 GWh of storage capacity in the form of batteries over the next nine years.

2022 also saw a Pakistani electric mobility startup receive a funding of \$1 million to

introduce electric bikes in the country. Named ezBike, the startup was previously running an on-demand rental service for electric bikes in Islamabad. After drawing in funding from local and international investors, the company aims to introduce its low cost bikes in a few months. They also have plans to set up a manufacturing plant for their bikes and produce low cost iron lithium batteries.²⁶

Electric two-wheeler market	Jolta Electric, Teleport, Sunra Pakistan, MS Group of Industries, VLEKTRA, Mode Mobility
Electric three-wheeler market	Sazgar Engineering Works, ZAR Motors
Electric passenger car market	MG JW Automobile Pakistan, Karakoram Motors, Topsun Motors, DICE Foundation
Hybrid passenger car market	Indus Motor Company, MG JW Automobile Motors
Electric high-transport vehicle market	Daewoo Express Pakistan
Battery market	Zoxcell, Barq Box, Fuel Motion Inc

²⁵https://pdf.usaid.gov/pdf_docs/PA00XXDK.pdf

²⁶<https://www.globalvillagespace.com/pakistans-ebike-raises-1-million-in-its-first-pre-seed-round/>

Pakistani Companies in the Autonomous Vehicles and EV Space

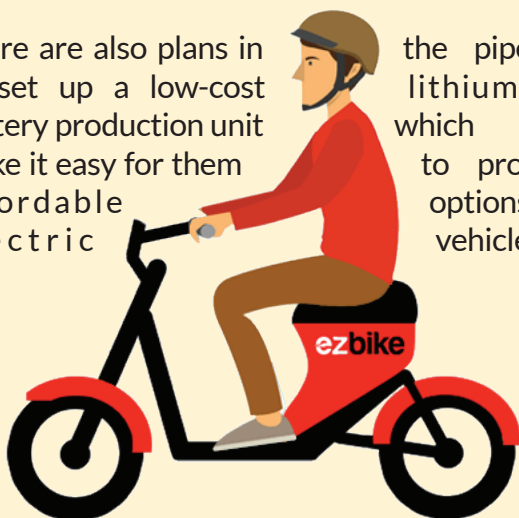
ezbike

ezBike

An app-based service that deploys electric bikes around the city, ezBike is Pakistan's first 'electric bike sharing service'. ezBike's mobile app allows users to locate and reserve electric bikes parked near them. Having onboarded over 100,000 customers since its inception in 2020, ezBike shows no signs of slowing down. The startup also holds the distinction of being the only EV startup to raise funding in Pakistan.

Their \$1million pre-seed round aims to increase the share of electric automobiles in the domestic market. However electric bikes for rent are just the tip of the iceberg for this mobility startup. The company also intends to start production soon for their very own electric scooters to provide the country with an alternative mobility solution in the face of rising fuel prices and the threat of a climate catastrophe fueled by car emissions.

There are also plans in the pipeline to set up a low-cost lithium-ion battery production unit which will make it easy for them to provide affordable electric options for vehicles.²⁷



Jolta Electric

Jolta Electric Pvt Ltd is Pakistan's first EV company. Its vision is to electrify the automobile industry in Pakistan to create a sustainable future for the upcoming generation. Jolta is an initiative by AUJ Technologies Pvt Ltd. As an EV technology provider, the company designs key components of electric vehicle kits for two, three, and four-wheelers.²⁸

The company launched Pakistan's first locally manufactured electric motorcycle in 2021.²⁹ They have a range of different products including scooty and electric cycles. The company sold 10,000 units to local customers in 2021.³⁰



²⁷<https://www.facebook.com/ezBikepk>

²⁸ <https://www.joltaelectric.com/about.html>

²⁹<http://www.joltaelectric.com/blogs/pm-imran-khan.html>

³⁰<https://propakistani.pk/2022/03/16/pakistans-jolta-electric-sold-10000-bikes-in-2021/>



Mode Mobility

Mode Mobility is an automotive design and engineering company based in Pakistan, focusing on developing sustainable mobility solutions. Mode Mobility's products are proudly designed in Pakistan, for Pakistan by Pakistanis. They are currently gearing up to launch a line of battery electric scooters designed to make motorcycle riding accessible to women.

Mode Mobility's first product line; the C-Series scooters are designed uniquely to survive the rigors of Pakistani cities and be affordable to run and maintain. Their long term goal is to become a world renowned automotive brand that is uniquely Pakistani.³¹



Sazgar Autos

A public limited company with one the largest manufacturing facilities based in Pakistan, Sazgar has a global presence in over 20 countries. Established in 1991, Sazgar enjoys an international demand for its e-wheelers.

In 2021, Sazgar launched a three-wheeler vehicle which provided comfort and agility with zero emissions. Sazgar eVe is a redesigned version of the iconic cultural rickshaw built over the same vehicle architecture and footprint. It has been modernly designed to fit the urban landscape.³²



Daewoo Express Pakistan

Daewoo Express Pakistan is a private bus service operator with its own fleet of buses, workshops, driver training institutes and mechanical staff. Daewoo is a part of the South Korean conglomerate Daewoo Group. The company offers inter-city common carrier services for passengers by bus to over fifty cities with a fleet of inter-city buses and operates government-contracted intra-city routes with utilisation of excess storage capacity.³³

Daewoo signed a strategic alliance agreement with Skywell Automobiles and Hitachi ABB Power Grids in 2021 to launch electric buses as well develop charging infrastructure in the country.³⁴ Currently Daewoo Express has started operating electric vans on the Rawalpindi-Murree route.³⁵



³¹<http://modemobility.pk/>

³²<https://sazgarautos.com>

³³<https://sazgarautos.com/eve/>

³⁴https://en.wikipedia.org/wiki/Daewoo_Express

³⁵<https://www.globalvillagespace.com/daewoo-launches-electric-vans-in-pakistan/>

VLEKTRA

VLEKTRA

V-LEKTRA (Vitality Electric Vehicles) is Pakistan's 1st lithium - ion - based motorcycle brand. It is backed by Vitality Capital, a New York-based investment firm. Its two limited edition brands, BOLT and RETRO, met with huge success and the first batch was completely sold out. The company is now taking reservations for its second batch.³⁶



Tesla Industries

Tesla Industries is a private limited company that has established its network of production and supply in more than 30 cities within the country and for the last 8 years has entered into engineering products exports. Their goal at Tesla is to design and produce hi-tech sophisticated and dependable equipment, controls and safety devices for domestic and industrial uses at affordable prices.³⁷

Tesla Industries introduced their EVx ultra-fast chargers for electric vehicles in 2021. The charger claims to fully charge a vehicle in 30 minutes.³⁸

³⁶<https://www.vlektra.com/>

³⁷<https://tesla-pv.com/>

³⁸<https://technologytimes.pk/2021/06/05/tesla-industries-introduces-ev-chargers-in-pakistan-at-cheapest-rates/>

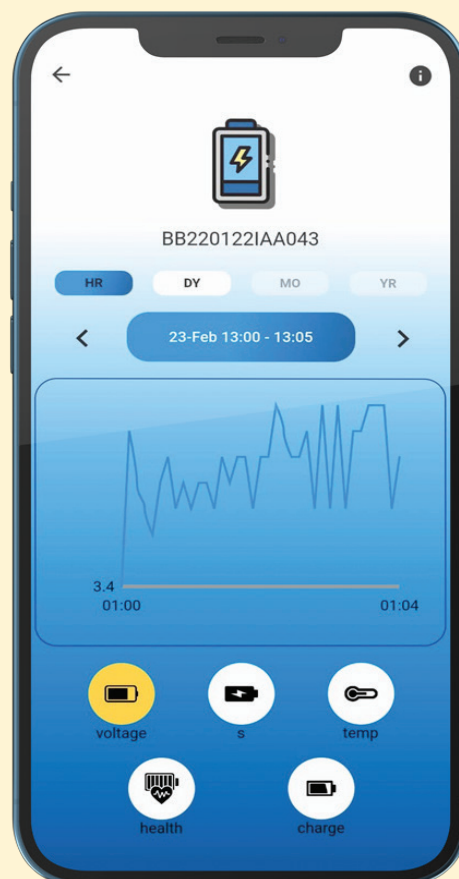
³⁹<https://barqbox.com/>

BARQBOX

BarqBox

BarqBox is an energy solutions company which presents itself as the first local manufacturer of intelligent Li-ion battery packs in Pakistan. BarqBox is born out of an alliance between Lahore University of Management Sciences (LUMS), Lahore Chamber of Commerce and Industry (LCCI), and Higher Education Commission (HEC).

Over the last 5 years, they have indigenously developed a patent-pending Li-ion battery architecture that is more versatile than imported options in the market. The project is owned by Sozo Group and the research partner is Lahore University of Management Sciences (LUMS).³⁹





Karakoram Motors

Karakoram Motors is a Pakistani automobile manufacturer based in Karachi, Sindh. They are a group company of Mecom Group of Companies. Launched in 2003, they have emerged as one of the leading automobile assemblers and importers of Chinese vehicles in the country.

The company is also planning to introduce the first locally manufactured electric passenger car in Pakistan. They have already acquired the sole-production rights for a Canadian firm DYNASTY and have started manufacturing these vehicles. Their brands include Chery, Changan, Gonow, Dynasty, and Raftar.⁴⁰



MORRIS GARAGES

MG JW Automobile Pakistan

One of the fastest-growing car brands in the world, the iconic British brand traces its roots back to 1942. The brand was introduced in Pakistan through a joint venture between SAIC and JW SEZ Pvt Ltd.⁴¹ MG JW Automobile Pakistan is owned by JW Auto Park which is in turn owned by Javed Afridi. The company has launched an all-electric, zero emissions SUV, which has a driving range of 320 km from a single charge, as well as hybrid SUVs.⁴²



⁴⁰<https://www.karakoramotors.com/>

⁴¹<https://mgmotors.com.pk/>

⁴²<https://mgmotors.com.pk/MG-ZS-EV>



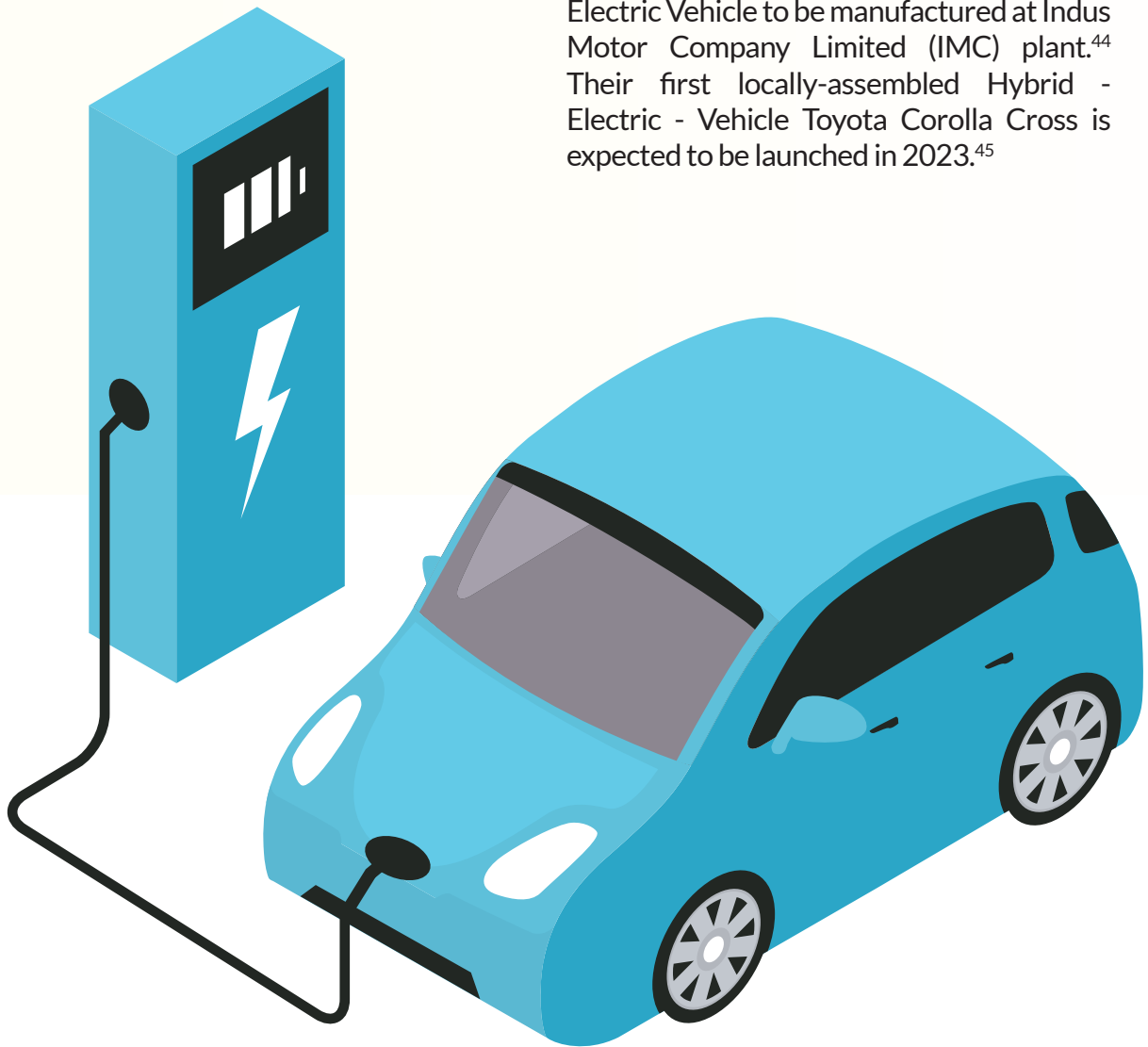
INDUS MOTOR COMPANY LTD.

Indus Motor Company

Indus Motor Company Limited, operating as Toyota Indus, was founded in 1989 as a joint venture between House of Habib, Toyota Tsusho, and Toyota Motors. It is one of the leading Pakistani automobile manufacturers which is a subsidiary of Japanese multinational automaker Toyota Motor Corporation. While currently they are only providing hybrid vehicles for

Pakistan, Toyota Motor Corporation⁴³ has invested over US\$100 million for the local production of Hybrid Electric Vehicles (HEV) in Pakistan.

The announced investment is supposed to be directed towards localization of components, plant expansion and production preparation for the Hybrid Electric Vehicle to be manufactured at Indus Motor Company Limited (IMC) plant.⁴⁴ Their first locally-assembled Hybrid - Electric - Vehicle Toyota Corolla Cross is expected to be launched in 2023.⁴⁵



⁴³<https://www.toyota-indus.com/>

⁴⁴<https://www.toyota-indus.com/toyota-usd-100-million-investment-in-pakistan/>

⁴⁵<https://www.brecorder.com/news/40175189>



Topsun Motors

Topsun Motors founded in 2018 is dedicated to marketing and manufacturing electric bikes and electric cars besides traditional fuel cars / trucks / SUVs. The company was launched by the government of Pakistan to implement the National Electric Vehicle Policy in partnership with China. The company was accorded the Greenfield status by the Ministry of Industries and Production.^{46 47}



MS Automobiles

MS Automobiles is a subsidiary of MS Group of Companies which was launched in 1984. MS Automobiles itself was launched in 2003 and they launched their first electric scooter in the same year. Besides conventional motorcycles, their range of products include an E-Heavy Bike, E-Scooter, MS-E125 and MS E-70.⁴⁸



⁴⁶<https://profit.pakistantoday.com.pk/2018/07/11/topsun-motors-pak-china-motors-accorded-greenfield-status/>

⁴⁷<https://topsunmotors.com/>

⁴⁸<https://msgroupofindustries.com/>

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